All-Fiber-Optic Photonic Crystal Light Emitter

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Efficient output coupling from photonic crystal light source has long been an issue toward practical stand-alone light source. We present the simple and effective scheme for the direct evanescent coupling with a tapered optical fiber, where both optical pumping and output collection are carried out through the same fiber. The sharply-curved tapered fiber was positioned above the three-defect laser cavity with an air gap less than 1 μm. 980 nm pump light was injected into the fiber though WDM coupler and transferred to the laser cavity. The laser output was coupled back to the fiber with the same coupling efficiency in the both directions.

Stable single mode lasing was observed with the low threshold of 35 μW. The output coupling efficiency was estimated to be as high as ~70% in the experiment, close to the theoretical value of 84% from FDTD simulation. This compact, stand-alone, fiber-coupled ultimate light source may find its immediate applications in quantum optics and optical communications.